EUROPEAN COMMISSION
DIRECTORATE-GENERAL FOR COMMUNICATIONS NETWORKS, CONTENT AND TECHNOLOGY

Artificial Intelligence and Digital Industry
Robotics and Artificial Intelligence

Reference Testing and Experimentation facilities in Digital Europe Programme

WORKSHOP ON AI TESTING AND EXPERIMENTATION FACILITIES FOR SMART MANUFACTURING

16 JANUARY 2020

1. BACKGROUND

The [DRAFT ORIENTATIONS FOR THE PREPARATION OF THE WORK PROGRAMME(S) 2021-2022] of the Digital Europe Programme state:

"[…] The first two years of the programme will focus on developing an infrastructure which offers businesses and the public sector access to AI tools and components and data resources, as well as reference testing and experimentation facilities in some prioritised application sectors.
Actions will focus on […]:

- **developing world-class large-scale reference Testing and Experimentation Facilities (TEF) for AI hardware, software, components, systems and solutions, and underlying resources (data, computing, cloud) in a number of sectors;[…]**

Developing Large Testing and Experimentation Facilities to provide a common, highly specialised resource to be shared at European level and foster the deployment of trustworthy AI in the following areas:

1) a common European platform to design and manufacture edge intelligence components and systems based on neuromorphic and quantum technologies;
2) reference sites for applications in essential sectors such as health, agri-food, manufacturing, smart cities and smart mobility (including environment and climate perspective)."

This orientations document also stressed the strong links that will be established with the initiative to **establish EU-wide common data spaces**.

2. EXECUTIVE SUMMARY

- Overall, 73 participants took part in the discussions, including industry players, RTOs, and Member States.
- The community is very positive about the planned AI Testing and Experimentation Facilities for Smart Manufacturing. Various facilities are available that could provide a suitable basis for AI Testing and Experimentation Facilities, and TEFs should, as far as possible, capitalise on existing facilities and previous investment. A number of other criteria will be taken into consideration in the selection of the facilities. An overwhelming majority of experts present in the workshop would like to see a call for manufacturing TEFs in 2021.
- A majority of experts present in the workshop supported a minimum budget of 10 million EUR per site, with 50 million EUR as the minimum funding level to have an

impact in the sector. Several facilities would be needed to cater to the diversity of the sector in its applications.

- Some discussions showed some confusion / lack of understanding on how TEFs would be different from Digital Innovation Hubs. More information to the community will help clarify the intentions of the AI TEFs.

3. EXISTING LANDSCAPE

In the workshop, the European Commission asked experts and Member States' representatives to provide examples of existing testing sites in the manufacturing sector. The examples provided and listed below do not influence the outcome of future calls, they just serve to illustrate the types of facilities, their setup, function, etc. Any Member State willing to provide to the European Commission additional examples of testing sites is welcome to do so.

EXPERTS

Workshop participants presented several existing facilities and projects, including:

- **ARENA 2036** in Stuttgart, Germany, which facilitates collaboration between research (University of Stuttgart, Fraunhofer, DLR) and industry players (Daimler, Bosch, Nokia, Siemens, Schunk, Pilz etc.).
- **RICAIP**: German-Czech centre of excellence in AI and industrial robotics since 2017 that will establish an industrial testbed core for testing new manufacturing solutions.
- **FactoryLab**: Launched in France in 2016, the tech-to-market accelerator programme Saclay brings together large multinationals, integrators and start-ups and offers support on industrial prototypes, training and business plans. It is hosted within the DIGIHALL DIH and co-located with the Data Cluster. It has access to the EU ecosystem thanks to its co-location with EIT Manufacturing HQ and Siemens Mindsphere centre. TEF could help by providing full manufacturing scenarios for test and development purposes and form a community at EU scale with other facilities.
- **FFLOR**: Inaugurated in January 2017, the Future Factory at Lorraine is a testbed and pilot line in Metz. There are more than 12 industry partners from France, Germany and Spain and involves SMEs, larger companies, end-users and integrators. The aim is to accelerate the introduction of agile manufacturing.
- **Smart Industry Fieldlabs**: Part of a fourth industrial revolution programme, the Smart Industry Fieldlabs are industrial environments where smart industry solutions are developed, tested, implemented as well as where people can learn to apply them. There are certain criteria to meet by future projects, e.g. 3+ year plan and multiple projects on innovation and education. Currently there are five Smart Industry centres (EU type regional DIH for manufacturing); each centre has 10 field labs in the region and each lab reaches ten industrial SMEs. By 2025, the programme aims to target 5000 SMEs and 25 000 by 2030.
- **VTT Technical Research Centre of Finland (TEPI)**: A research and piloting platform for various research projects and use cases. Includes 5G test network, industrial internet within printed intelligence factory floor, and smart building (facilities and energy systems). Computational capabilities for AI available via big

data platforms and possibility to use HPC, which can be used for manufacturing cases.

- **Aeronautics Advanced Manufacturing Centre (CFAA)**: The Centro de Fabricación Avanzada Aeronáutica (CFAA) in the Bizkaia technology park near Bilbao seeks to promote collaborative research and development between machine-tool manufacturers and Tier 1 and 2 businesses in the aeronautics engine sector. It also seeks to enable a quick transfer of results to the production setting associated to the value chain.
- **EURECAT Technology Institute:** Based in Barcelona, it has multiple sites (industrial infrastructures with integrated AI capabilities) covering different industrial processes such as stamping, injection, milling and casting. The sites have access to computing infrastructures for intensive or continuous calculation (Cloud, HPC), and GPU accelerated data aggregation and processing systems. Likewise, these infrastructures are complemented with IoT, cybersecurity, robotics laboratories, which currently deploy and test developments and AI solutions. The institute has promoted Industry 4.0 for over 5 years through consultancy services and training as a means to generate the industrial demand of advanced technology services.
- **Flanders Make:** Flanders Make is a research centre for the manufacturing industry. The testing lab has different load profiles, access to cloud computing and 7 parallel set-ups for gearbox testing. It also has seven assembly stations with continuous production, data capturing capabilities (cameras, electrical, pneumatic) and automatic stations and operation stations.
- **Jožef Stefan Institute**: Based in Ljubljana, Slovenia, the organization has a number of departments and laboratories such as the "Department of automation, biocybernetics and robotics" and other departments active in knowledge technologies. Besides R&D, the Institute has a long history of experience cooperating with the manufacturing sector.
- **Italian Competence Centre for Industry 4.0**: Italian Ministry of Economic Development funded the research centre MADE to support Italian business to transform to Industry 4.0. MADE was able to attract a number of key technology providers as IBM, SAP, CISCO.
- **Zurich University of Applied Sciences (ZHAW)**: ZHAW is a leading national and international recognized centre of excellence for research, teaching and services in the area of data science. ZHAW's Datalab cooperates with industry, thus enabling innovation and transfer of technology. In order to accomplish these goals, it fosters interdisciplinary collaboration and exchange of ideas among its members and associates. Together with the Interreg project "Machining 4.0" and academic partners from Europe, ZHAW intends to merge the Swiss Digital Learning Factory into a network of connected learning factories. This will enhance the possibilities for learning and teaching but at the same time the R&D cooperation with industry.

At the workshop many experts also presented national programmes like the Dutch Smart industry fieldlabs and the German Industrie 4.0 testbeds (LNI4.0). However, the fieldlabs provide facilities to SMEs to get first experiences with new digital technologies, rather than facilities for validating new AI hardware, software, components, systems and solutions in the manufacturing sector. Therefore, they are more comparable to DIHs than TEFs.

4. Needs and Impact

EXPERTS

Several experts listed the following **needs** for TEFs for the manufacturing sector:

- **Hybrid environments**: Facilities should have both digital and physical elements. Digital can be a cost-efficient way to test new solutions, but this is not always possible to the full extent, which is why facilities should also include physical elements for testing. Physical testing is especially important for example in machine vision, planning of robotic operations such as grasping and human involvement.
- **Regional**: TEFs to focus on needs of regional manufacturing industry (few hundred kms vicinity to SMEs particularly). German network of Industry 4.0 testbeds given as an example to follow. On the other hand, it was also said that there should be a few large centres in which entire production lines with components from different manufacturers should be set up as experimental areas.
- **Easy access & use**: This could mean short travelling, simple access procedures, reliability, transparency (price, working procedures, transparent legal rules on access and use of the results) and adaptability in operational work for use. Sound concept for the integrated provision of real and virtual test environments (resources and data). This also means easy integration in existing manufacturing sites and flexibility to adapt to manufacturing reconfiguration according to one expert.
- **Open access**: Open data standards, open source algorithms, platforms etc.
- **Best practices**: One expert argued it's not about open data, but sharing best practices among the sites. Some experts also discussed whether the results of the testing should be made available, but there was a pushback, arguing business secrets are often involved.
- **Support**: Specialists should be on site to provide operational support to TEF users. Other than engineering, data science, etc. and legal support would also be needed.
- **Resources**: Access to data sets, HPCs, IoTs, AI models but also edge AI was stressed. In terms of the physical infrastructure, several elements were mentioned such as maintenance and report support (see below for more detail in next section).
- **Collaboration**: TEFs should have access to common tools and solutions. TEFs should also tap into the DIH network to connect with users.
- **Interoperability**: Currently only local point to point connections exist at the sites, but TEFs should be interoperable. One expert said that 20% of the grant should be invested in interoperability.
- **Network**: TEFs should act as a meeting point between industry and academia as well as SMEs to allow for knowledge sharing. One expert emphasised the challenge for Europe was how to ensure collaboration between players operating in densely and sparsely populated countries.
- **Complementary network**: The different TEFs should have different foci to ensure a complementarity between the different sites. Another argued that the TEFs should be a network of smaller and bigger testing sites where the bigger ones would be responsible for maintaining the network (coordination, etc.).
- **Training/education**: TEFs have a role in facilitating knowledge transfer and training, including vocational. This can be done through open lab days, quick checks, exploring projects and pilots/demonstrators.
- **Validation/Certification**: The goal of TEFs should be to provide a certification of having passed the test. One expert offered "Trustworthy AI Made in Europe" as a way to promote the European approach. The validation criteria for testing should be

the same in all TEFs. Given the lack of an established methodology in the industry, proof-of-concept projects are required in TEFs. The process could follow the National Institute of Standards and Technology (NIST) process in the USA where biometric algorithm providers have to submit their algorithms for independent compliance testing.

- **Standardisation**: Some experts argued that global standardisation bodies should be closely involved. There was also a discussion as to whether the public sector should engage in a top-down fashion to promote new standards or whether this should be left to the market to decide. The latter option was seen as more favourable for the strong players. Standardising AI methods, especially of explainable, robust and safe AI, is needed, as currently the absence of standards means test results are incomparable, which in turn might lead to overfitting and failures of AI models.
- **Data**: Datasets are important for AI, but are expensive to create (labelling, quality control, etc.) for realistic use cases. Other than access to data, integrating data from third parties or public sources and contextualising were highlighted as challenges. However, one expert expressed caution, saying that it's not yet clear whether a common data framework is needed and that this should be tested.
- **Data sharing**: Sharing data between businesses/RTOs was seen as challenging from a regulatory, business and technical perspective by one expert. Another argued that standardisation would help solve the problem of data access.
- **Data ownership & cloud computing**: One expert warned that if you upload your IoT data onto the main cloud computing providers, you can lose ownership. This data security was seen as one of the main reasons why several experts supported GAIA-X and its connection to the TEFs initiative. Others also emphasised the need for data security and sovereignty for business users to have trust in TEFs.

One expert argued for a **greater professionalization** of the testing, explaining that the step from research to testing resembles in practice a more iterative process, requiring more funding until the research has been successfully tested several times. This also requires more funding.

In addition to improving the manufacturing process and the resulting higher quality of the products, several experts listed the following **impacts** TEFs in the manufacturing sector would have:

- **Competitiveness**: TEFs were seen as important to boost Europe's competitiveness by facilitating the deployment of new technologies, boosting research and training. This is because the testing would result in lower risks and costs for companies to use AI solutions.
- **Innovation**: TEFs could help European companies become more innovative by facilitating the move along TRL from proof-of-concept to production system and make its manufacturing process more effective and optimised as a result.
- **Benchmarking**: the testing could allow comparison of different AI solutions and lead to establishing benchmarks for specific AI solutions. The criteria for testing should be the same in all TEFs.
- **Trust and awareness**: TEFs could play a role in raising awareness about AI, which in turn would help citizens understand that they can trust manufacturing AI solutions "made in Europe".
- **SMEs**: TEFs offer equipment, resources (data) and competence (feasibility assessment, prototypical solutions for use cases) not usually available to SMEs, allowing them to compete with bigger firms on innovation. One expert cautioned that

TEFs should be strategic on which SMEs should be invited to use the facilities as resources are limited.

- **Knowledge & skills**: Players in manufacturing ecosystems will learn more about AI applications and how to use them in manufacturing thanks to TEFs which will also improve the skill-set of current and future labour populations.
- **Sustainability**: TEFs should aim to make manufacturing and AI more environmentally friendly by reducing among others energy consumption. One expert believed that TEFs could help to work towards the UN Sustainable Development Goals.

Grand challenges identified by experts that TEFs could help tackle included:

- **New research**: move away from current corporate R&D (focus on own business model, unique selling proposition, intellectual property) to research platforms (shared risks, competences beyond own business model, co-creation in disruptive research to own business).
- **Smart manufacturing's ultimate ambitions**: zero defect (100% quality control at each production step), zero delay (lean manufacturing, just-in-time), zero programming (2G/3G robots with sensing), zero tooling (3D printing/additive manufacturing), zero surprise (predictive maintenance), zero waste (recycling and sustainable energy) and zero drop-out (life-long learning for everyone).
- **Key technologies**: Robotics and autonomous systems, cyber physical systems (e.g. embedded systems, Edge AI), IoT, Artificial Intelligence and cognitive systems.
- **Addressing the skills shortage**

Promising areas/ major use cases mentioned by experts were intralogistics, production automation (e.g. Singular Value Decomposition based approach), flexible production in high-throughput and high-variety environment (agile manufacturing), use of edge computing, cyber-physical systems and IoT; use of AI-enabled process simulation (e.g. for lightweight production technology), digital twins, product and production optimization (energy, material, transport); predictive maintenance; mobile and collaborative Robots (object recognition, human-machine collaboration, cooperating robot teams, drones for inspection); integration of additive and subtractive manufacturing; trustworthy, transferable, and scalable industrial AI for manufacturing. Supply Chain Management (scheduling, logistic optimisation, raw material sourcing), novelty detection, hyper-personalisation, complex environments with multiple processes with various degrees of automation, sales and commissioning (e.g. identifying customer needs, accelerating configuration, facilitating machine ramp-up) were also provided as examples. Other use case examples included advanced systems engineering and rapid prototyping, especially for SMEs and social manufacturing.

One expert argued that TEFs should also seek to introduce AI (and automation) into sectors beyond automotive, aerospace and electronics which are already highly automated. Such sectors would be textile, leather, construction, rubber, plastic, etc.

One expert structured promising areas and major use cases into four different buckets:

- **Machine learning**: explainable AI, automated machine learning, decision-making & machine learning under uncertainty
- **Image and signal processing**: quality control, image simulation, event analytics, sensor planning
- **Production**: production/machine control, track & trace, generative product design

- **Robotics**: human-robot-collaboration, reinforcement learning, meta-/transfer-learning

Valuable and attractive use cases for SMEs at TEFs include the following according to the experts:

- Testing AI reliability and use them as reference cases, e.g. when AI is essential in decision making, scheduling in maintenance actions with high costs;
- Concrete use cases mentioned: Inline quality assurance, condition monitoring and prediction, predictive maintenance, production process optimization, autonomous production planning/control, lot scheduling, robotics applications, condition based monitoring, communication between humans and machines, digital twins.

5. STRUCTURE OF THE "FACILITIES"

EXPERTS

According to many experts, the structure of the TEF should have the following characteristics:

- **Size**: Some experts argued for small TEFs as these would be more interesting for SMEs. One expert suggested 1000+ TEFs in Europe, others for (bigger) ones that would be in total 3-5, 5-10, 20-30, 40-60 facilities or one per Member State. Many argued for a market-driven approach. One expert said that the ideal size depends on the technological focus. For example, robotic assembly can be realized on small/medium scales as well, whereas laser processing requires larger investments. One of the presenters set the minimum budget per site at €10 million. Some experts argued for the TEFs to be mainly large and few digital marketplaces (cloud computing and AI algorithm platforms) to which local testbeds could connect.
- **Location (regional)**: Responses from experts and national delegations to a live poll conducted at the workshop indicated that the majority (55%) wanted to have many (more than 10) TEFs to be spread geographically. 31% believed there should be few TEFs (less than 10) spread geographically. Many thought that TEFs should focus on needs of regional manufacturing industry (few hundred km vicinity to SMEs or maximum 4 hour train/car ride away). German network of Industry 4.0 testbeds given as an example to follow. However, others rejected this "linear" thinking as it was more important to see where TEFs could build on existing networks, excellence centres and cross-border collaboration opportunities.
- **Hybrid environments**: Facilities should have both digital and physical elements. Digital can be a cost-efficient way to test new solutions, but this is not always possible, which is why facilities should also include physical elements for testing such as pilot production lines and end-user access to them. Physical testing is especially important for example in machine vision, planning of robotic operations like grasping and human involvement. Ideally, a wide range of use cases should be offered. Physical elements extend beyond shop-floor production to collaboration mechanisms (logistical, financial, etc.).
- **Real world**: Many experts emphasised the need for real-world conditions at the TEFs, including design and prototyping sector, integrated assembly line, complete supply chain including inbound and outbound logistic, and multi-source energy supply. One expert argued that TEFs should be done in high TRL environment (TRL 5-8) so that existing employees can join and be trained.

- **Complementary network & focus**: The different TEFs should have different foci on different aspects of manufacturing to ensure complementarity between the different sites. Others argued that the TEFs should be a network of smaller and bigger testing sites where the bigger ones would be responsible for maintaining the network (coordination, etc.).
- **Easy access & use**: This could mean short travelling, simple access procedures for access, reliability, transparency (price, working procedures) and adaptability in operational work for use. One expert mentioned that insurances and other legal requirements could stop end-users using laboratories and equipment, which needs to be addressed in the calls for the TEFs. A mechanism for "AI-acclimatisation" for newcomers should be foreseen in order to facilitate access for Non-IT SMEs.
- **Open access**: Open data standards, open source algorithm platforms, etc. Some experts also discussed whether the results of the testing should be made available, but there was a pushback, pointing to the needs of strict protection of IPR and non-disclosure agreements.
- **Resources**: Access to data sets, CPU and GPU servers, HPCs but also edge AI was stressed. This also means integration with key initiatives, e.g. EuroHPC, GAIA-X, German Edge Cloud.
- **Support**: Specialists such as computer scientists, mathematicians, software engineers, project managers and manufacturers should be on site to support TEF users, as well as educational offers. According to one expert, AI personnel is the biggest bottleneck and should become a priority and dealt with by pragmatic solutions (longer MOOC as universities are too slow to produce the required talent in time, e.g. 6-12 month MOOCs compared to 4-5 year degrees).
- **Collaboration**: TEFs should have access to common tools and solutions, including data-sharing, and ensure interoperability, e.g. MQTT, OPC UA. TEFs should also tap into the DIH network to connect with users. When asked in the live poll on collaboration, experts and national delegations preferred to put systematic mechanisms between the TEFs and other relevant projects like DIHs, data spaces and the AI-on-demand-platform in place (40%). Open standards, open data and software platform were the second most preferred option to ensure good collaboration with other relevant projects (19%). Other, less popular options included contractual agreements like MoUs (14%), regular dialogue in one forum (10%) and a coordination and support action (10%). One expert argued TEFs should agree on joint objectives for all sites, exchange of knowledge and development plans. Another proposed to have researcher mobility exchanges between research and innovation centres.
- **End user involvement**: The IT infrastructure should also connect to the end-user sites. Demonstrators (digital twins) should deploy end-user environments.
- **Sandboxes**: Different experts mentioned the need for sandboxes for services, particularly highlighting the difficulties around data-sharing (GDPR-free sandbox) and data ownership, but also monitoring and safety. Most emphasised the need for B2C sandboxes, some B2B and B2G. One expert cautioned that sandboxes should be connected across the TEF network to concrete standardisation efforts otherwise there will be little usefulness.

When speaking about difficulties on the **practical implementation**, the need for human-to-human interaction, need for the right resources and expert staff support (see above) and practical, legal and business hurdles for data-sharing, investment thresholds, new AI solutions with a value proposition for all parties involved and ease of use were often highlighted. One expert particularly highlighted that one of the biggest practical hurdles is that one-off testing is not enough and there needs to be an iterative process between research and testing which requires higher funding, to avoid the so-called "valley of death". Another argued market forces would reward well-run TEFs (and punish poorly-run TEFs) and deal with any practical implementation barriers. Choosing existing facilities with a proven background in manufacturing could be effective in addressing these practical implementation issues. One expert cautioned that efficiency of the TEFs will depend on the emergence and consolidation of European AI integrators for manufacturing that are able to work with SMEs.

6. TIMING

EXPERTS

The majority of **experts and national delegations** at the workshop believed that the sector is ready to absorb funding for TEFs. In a live poll conducted at the workshop, 79% believed the call should be made in 2021, while 12% it should be in 2022 and 7% in 2023-24. Only 2% thought the call should be done in 2025-26. Some believe readiness to depend on the technology. Some applications like predictive quality in production line are already high, but others' maturity is still low, e.g. reconfigurable production/assembly line for customized production.

One expert explained that there are several assessment methods available to assess maturity, e.g. SIRI – Smart Industry Readiness Index – from Singapore and KEX AG from Germany. The expert argued that it is important to use industry-based benchmarks for SMEs as well as a practical roadmap.

According to many experts, the first phase (2021-22) should focus on setting up the framework and network for the TEFs and identifying the needs. The remaining years should be used to select certain sectors within manufacturing with a plan to integrate more over the duration of the project and to develop mature industrial application with high TRL levels. One expert said that testing should, in the short term, focus on less complex applications and then advance to more complex ones. Another argued the second phase should focus on technology transfer and scale-up, whereby the TEFs should act as a technology brokerage platform between technology providers and end-users, especially start-ups.

7. FUNDING

EXPERTS

Several experts gave **cost estimates** for the TEFs. Most put the cost of one TEF at € 2-3 million per year, while some said this level of annual funding per facility should be maintained over at least three years. Others said one new facility would cost €4-10 million. One expert believed resorting to existing facilities would be more cost-efficient. A more modest facility could be built at € 0.6 million according to one expert. One expert put the value of an existing centre of excellence with four manufacturing testing/research sites at € 63-68 million, similar to another's cost estimate at €20 million per facility.

Miscellaneous points raised by individual experts:

- **Interoperability**: 20% of the grant should be invested in interoperability.
- **Professionalisation**: There should be greater professionalisation of the testing, explaining that the step from research to testing resembles in practice a more

iterative process, requiring more funding until the research has been successfully tested several times.

- **Regional and national funding**: Experts reported most often good experience with national funding and almost as often for regional funding. One expert said that regional funding sometimes limits the role of solution providers from outside that region or country. Most welcomed private investment, but some experts were more worried that this would have a negative impact on open access for example.
- **Fee-based structure**: Several existing projects move towards a fee-based structure and use reduced effective public funding as a measure of success as it suggests financial sustainability. One expert argued for fully embracing the market model where competition would allow service levels to be measured and customer feedback gathered
- **SMEs** should especially be funded by the EU. One expert even argued that their accommodation and labour should be covered to ensure that SMEs will use TEFs.

In a live poll, experts and national delegations gave the following feedback on funding:

- 59% believed that the minimum funding needed to make an impact in the sector is at €50 million. Others believed this threshold to be at €20 million (25%) or at €35 million (16%).
- 44% think that the minimum funding per facility should be at €10 million and 37% want it at €20 million. 9% believed the minimum funding for one facility should be at €30 million or and another 9% thought it should be €40 million.
- 61% said that national funding, e.g. from national strategies, should be the source of Member State co-funding for the facility and travelling. 30% believed it should be regional funding and 9% said it should be other sources.
- An overwhelming majority (87%) believed that the remaining 50% of the Member State funding for the facility should be covered in kind and in cash, while 8% said it should be in cash and 5% in kind.
- 62% said that no reimbursement of costs other than travel should be made, while 14% believed that non-travel costs should be reimbursed by the grant at 25%, 12% thought this should be at 50% and 12% it should be at 100%.
- 56% said they would invest 5-10% of the travel costs, while 24% said they would use 10-20% of the grant and another 15% would use up to 5%. Only 5% would use more than 20% for travel costs.
- 49% said they would invest 25-50% of the grant in equipment and facilities, while 37% would invest 50-75%. 10% would invest up to 25% of the grant in equipment and facilities while only 5% said they would invest 75-100% of the grant.
- 50% said they would invest 50-75% of the grant in personnel costs, including subcontracting and 33% said it would be 25-50%. A minority would invest either 75-100% (15% of the respondents) or up to 25% (3% of the respondents).

8. EU ADDED VALUE

EXPERTS

Experts believed TEFs could lead to **economies of scale** on the following issues:

- **Legal standards**: TEFs could help in pushing for EU standards to become global ones, thereby helping European industry to become more competitive in AI.

- **Partnerships**: Cross-border European partnerships were seen as a key advantage of an EU-co-financed TEF as they allow to reach a certain scale.
- **Expertise:** TEFs at EU level could help bring together the expertise in different Member States, bringing companies to the same level regardless from which Member State.
- **Specialisation:** TEFs could help in allowing the European manufacturing industry to specialise.
- **Digitalisation**: TEFs would be an important tool to master digitalisation and ensure Europe could make good use of new solutions like Big Data and AI.
- **Competitiveness**: TEFs could help manufacturing stay competitive while labour population doesn't increase. TEFs achieve this by reducing risks and costs and speed up paths to market-readiness for companies to use AI solutions.

When asked about the **needs and impact of the shared/common resource as opposed to distributed efforts**, experts emphasised particularly the need to cover the entire spectrum of manufacturing, connecting the different players in Member States, creating common standards for better collaboration and scale, e.g. data-sharing standards, access to more and better resources, e.g. HPC, datasets, being accessible (4h drive distance). Other points raised by individual experts included coordination efforts, the provisions of expert support and the education role TEFs could play in providing training to students and (small) business.

One expert argued that there's no contradiction between shared and distributed efforts because if TEFs would follow an integrated approach both shared and distributed efforts would be possible.

Experts offered different factors so that TEFs would be **sufficiently attractive to cross-border European efforts** including:

- TEFs will be driven by industrial use cases from the start to understand the technical and organisational requirements, in other words a clear value proposition.
- Services are provided in a business efficient manner regarding quality standards, delivery time and price policies.
- The provision of a seal of excellence, visibility and facilitated access to potential end users.
- A clear funding model. One expert suggested an EU voucher system to be created whereby companies with the vouchers could spend them at any TEF in Europe.
- "Trustworthy AI made in Europe" would become a quality assurance for manufacturing solutions.
- Data sets to be open to third party users, reliable and sufficiently representative of industry.

Experts offered the following measures to ensure that TEFs would be **open to external stakeholders across the EU**:

- Open access policies on issues such as data-sharing,
- Collaborative platforms established before allowing external stakeholders to use TEFs,
- Use of public universities as public space for students, researchers and companies,
- Clear rules on IPR,
- Organised as public-private-partnership,

- Preventing private actors from running the TEFs (one expert suggested using “neutral” RTOs), and
- Make openness to external stakeholders a contractual and measureable requirement.

9. Ecosystems – access to value-chains

EXPERTS

Given the many different operational sites in Germany, France and the Netherlands and cross-border cooperation like the Vanguard Initiative, many considered the **supply-chains to be available and ready**. The vast majority of workshop participants (79%) thought the industry could absorb the funding already at the earliest point, i.e. 2021-2022.

Expert support was seen as important for the success of TEFs and as a major benefit of the programme. Some believed that more access to consulting services was needed. Some also argued for the involvement of international standardisation bodies, even though there was a disagreement whether standardisation should be pushed top-down or bottom-up.

Moreover, TEFs were seen to have a multidisciplinary/cross-sectoral role as they can help to deploy and test entire AI supply chain in different ways and sectors.

The following **expertise** was seen as important to have access to: system integration, business development, validation and testing, demonstrators and use cases, awareness raising, relation management and IIoT infrastructure. Others believed it to be manufacturing knowledge, production knowledge, AI and Machine Learning skills and knowledge, sensor selection and implementation, data collection and analysis. Overall, the TEFs should be set up as a hub with access to a wide range of skills in the form of cross-functional teams, including, but not limited to: AI researchers, software engineers, DevOps experts, mechanical engineers, automation engineers, supply-chain experts, sales and technology experts, lawyers, insurance experts, business incubators and contacts to investors. The following AI-services were seen as important to have access to: machine learning, robotics, planning and scheduling, computer vision, formal methods, natural language processing, automated reasoning, game theory, multi-agent systems, complex systems, system verification, bioinformatics and others.

One expert also highlighted the need for a coordinating role between other TEFs and resources, like DIHs. Another emphasised the need for different players – SMEs, corporations, education and research centres – to be at the TEFs.

10. Conclusions

The TEFs should be ideally done by a European consortium and reflect the diversity and needs of the manufacturing sector, requiring several facilities for the different types of applications. Various facilities are available that could provide a suitable basis for AI Testing and Experimentation Facilities, and TEFs should, as far as possible, capitalise on existing facilities and previous investment. A number of other criteria will be taken into consideration in the selection of the facilities. The sector seems ready to absorb the funding at this point in time. Collaboration between other projects, notably DIHs, is important, but requires further clarification.

Next steps will be:

- clarification of the TEF form and structure, timing and process lifecycle, mode of operation, including interaction with any size company e.g. large, SMEs, Start-ups, Academia, etc.
- description of funding mechanisms.

The experts and national delegations were asked to participate in a live poll at the workshop and gave the following indications on **funding, timing, collaboration mechanisms and project structure**:

- The majority of **experts and national delegations** at the workshop believed that the sector is ready to absorb funding for TEFs. 79% believed the call should be made in 2021, while 12% it should be in 2022 and 7% in 2023-24. Only 2% thought the call should be done in 2025-26.

- The majority (55%) wanted to have many (more than 10) TEFs to be spread geographically. 31% believed there should be few TEF (less than 10) spread geographically. A clear minority wanted the TEFs to be geographically concentrated (2% wanted few TEF to be geographically concentrated and 12% wanted many TEFs, to be geographically concentrated).

- 59% believed that the minimum funding needed to make an impact in the sector is at €50 million. Others believed this threshold to be at €20 million (25%) or at €35 million (16%).
- 44% think that the minimum funding per facility should be at €10 million and 37% want it at €20 million. 9% believed the minimum funding for one facility should be at €30 million or and another 9% thought it should be €40 million.
- 61% said that national funding, e.g. from national strategies, should be the source of Member State co-funding for the facility and travelling. 30% believed it should be regional funding and 9% said it should be other sources.
- An overwhelming majority (87%) believed that the remaining 50% of the Member State funding for the facility should be covered in kind and in cash, while 8% said it should be in cash and 5% in kind.
- 62% said that no reimbursement of costs other than travel should be made, while 14% believed that non-travel costs should be reimbursed by the grant at 25%, 12% this should be at 50% and 12% it should be at 100%.
- 56% said they would invest 5-10% on travel costs, while 24% said they would use 10-20% of the grant and another 15% would use up to 5%. Only 5% would use more than 20% for travel costs.
- 49% said they would invest 25-50% of the grant in equipment and facilities, while 37% would invest 50-75%. 10% would invest up to 25% of the grant in equipment and facilities while only 5% said they would invest 75-100% of the grant.
- 50% said they would invest 50-75% of the grant in personnel costs, including subcontracting and 33% said it would be 25-50%. A minority would invest either 75-100% (15% of the respondents) or up to 25% (3% of the respondents).
- An overwhelming majority (76%) preferred a consortium to handle the grant for several facilities rather than an individual partner (24%).
- When asked on collaboration, experts and national delegations preferred to put systematic mechanisms between the TEF and other relevant projects like DIHs, data spaces and the AI-on-demand-platform in place (40%). Open standards, open data and software platform were the second most preferred option to ensure good collaboration with other relevant projects (19%). Other, less popular options

included contractual agreements like MoUs (14%), regular dialogue in one forum (10%) and a coordination and support action (10%).